VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

October 28, 2004

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Serial No. 04-380A
NL&OS/ETS R0
Docket Nos. 50-338/339
License Nos. NPF-4/7

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2
REQUEST FOR ADDITIONAL INFORMATION
PROPOSED TECHNICAL SPECIFICATIONS CHANGE REQUEST
REACTOR COOLANT SYSTEM PRESSURE/TEMPERATURE LIMITS
LTOPS SETPOINTS AND LTOPS ENABLE TEMPERATURES

In a letter dated July 1, 2004 (Serial No. 04-380), Dominion requested an amendment to Facility Operating License Numbers NPF-4 and NPF-7 in the form of changes to the Technical Specifications for North Anna Power Station Units 1 and 2. The proposed changes will provide Reactor Coolant System (RCS) pressure/temperature (P/T) operating limits, Low Temperature Overpressure Protection System (LTOPS) setpoint allowable values, and LTOPS enable temperature (T_{enable}) values to cumulative core burnups up to 50.3 Effective Full Power Years (EFPY) and 52.3 EFPY, which corresponding to the period of the renewed license, for Units 1 and 2, respectively. In an October 13, 2004 telephone conference call, the NRC staff requested additional information to continue the review of the proposed Technical Specification Changes. The requested information is provided in the attachment to this letter.

Dominion continues to request a six-month implementation period to accommodate the numerous licensing basis changes necessary to implement the revised pressure/temperature limits. The current pressure/temperature limits remain valid to the years 2018 (32.3 EFPY) and 2020 (34.3 EFPY) for North Anna Unit 1 and 2, respectively. The extended implementation time will have no impact on safe operation of North Anna Units 1 and 2.

Should you have any questions or require additional information, please contact Mr. Thomas Shaub at (804) 273-2763.

Very truly yours,

Leslie N. Hartz
Vice President – Nuclear Engineering

Attachment

Commitments made in this letter: None

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SN: 04-380A
Docket Nos.: 50-338/339
Subject: RAI License Amendment RCS PT Limits and LTOP Enable Setpoints

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Leslie N. Hartz who is Vice President – Nuclear Engineering of Virginia Electric and Power Company. She has affirmed before me that she is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of her knowledge and belief.

Acknowledged before me this 28th day of October, 2004.

My Commission Expires: May 31, 2006.

Vicki L. Hull
Notary Public

(SEAL)

Attachment 1
(Serial No. 04-380A)
Virginia Electric and Power Company
North Anna Power Station Units 1 and 2

Request for Additional Information
Proposed Technical Specification Changes for
Reactor Coolant System Pressure/Temperature Limits
LTOPS Setpoints and LTOPS Enable Temperatures

North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company
(Dominion)

NRC Question 1

Sections 3.2.3, 3.2.4, and 3.2.5 examine the pressure and temperature instrument error and the corresponding uncertainty corrections. Please verify that the values used are limiting values and will not need adjustment with time due to instrument drift, aging, repair or replacement.

Dominion Response

The values used for the pressure and temperature measurement uncertainties are considered limiting values and are not expected to require adjustment. The channel statistical accuracy (CSA) determination includes a conservative value for instrument drift. Issues related to aging, repair or replacement are dispositioned via the I&C calibration program. The pressure and temperature instruments in question are functionally tested quarterly and receive calibrations every 18 months. The conservatisms in the CSA determination and the calibration and testing required for the pressure and temperature instrumentation ensures that the values used for the determination of RCS P/T limits, LTOPS setpoints, and LTOPS T_{enable} remain limiting and conservative.

NRC Question 2

Section 3.2.2 lists the fluence of the critical element for both Units (Unit 2 lower shelf forging 990533/297355) at the end of extended license as 5.91×10^{19} n/cm^2. The staff approved a plant specific vessel fast neutron fluence methodology for VEPCO in topical report VEP NAF-3-A, dated November 1997, "Reactor Vessel Fluence Analysis Methodology." However, this topical report approval was issued well before the staff issued RG 1.190. Does the methodology of VEPCO's fluence topical report adhere to the guidance of RG 1.190?

Dominion Response

The following is a comparison between the Summary of Regulatory Positions from RG 1.190 (with the applicable requirements from the body of RG 1.190 included) and the Summary of Compliance from VEP-NAF-3-A (Appendix 1 of Reference 1). The Dominion fluence topical methodology was originally validated against the draft RG (Reference 4). For each item, the RG 1.190 language is provided followed by a response that either provides the location in Appendix 1 of Reference 1 where the requirement was previously resolved or a specific response for the particular requirement. The comparison demonstrates that Dominion has met the requirements verbatim or, as discussed in the Methods Qualification, by equivalent demonstration. Therefore, the current fluence projections calculated using the methodology of Reference 1 are acceptable for use on the Surry and North Anna reactor vessels.

Comparison of VEP-NAF-3-A with the Requirements of Regulatory Guide 1.190

Fluence Determination - Absolute fluence calculations, rather than extrapolated fluence measurements, must be used for the fluence determination.

Response: As described in Section 2.1 of Reference 1, the methodology employs a direct calculation of the reactor vessel fluence (i.e., extrapolated measurements are not used in VEP-NAF-3-A).

Modeling Data - The calculation modeling (geometry, materials, etc.) should be based on documented and verified plant-specific data.

Response: Reference 1 responded to a corresponding item on pages A1 and A2.

Nuclear Data - The latest version of the Evaluated Nuclear Data File (ENDF/B) should be used for determining nuclear cross-sections. Cross-section sets based on earlier or equivalent nuclear-data sets that have been thoroughly benchmarked are also acceptable. When the recommended cross-section data change, the effect of these changes on the licensee-specific methodology must be evaluated and the fluence estimates updated when the effects are significant.

Response: Reference 1 responded to a corresponding item on pages A3 and A4. The latest versions available at the time of preparation of Reference 1 were used (i.e., ENDF/B-VI cross-sections and the BUGLE-93 library) in Reference 1. In addition, the methodology was thoroughly benchmarked using PCA experiments, in-vessel and ex-vessel measurements, and a comparison using two independent codes (MCNP and DORT).

Cross-Section Angular Representation - In discrete ordinates transport calculations, a P3 angular decomposition of the scattering cross-sections (at a minimum) must be employed. The master library should include a sufficiently large number of groups (≥100) that differences between the shape of the assumed flux spectrum and the true flux have a negligible effect on the multigroup data.

Response: Reference 1 responded to a corresponding item on page A4.

Cross-Section Group Collapsing - The adequacy of the collapsed job library must be demonstrated by comparing calculations for a representative configuration performed with both the master library and the job library.

Response: Reference 1 responded to a corresponding item on page A5.

Neutron Source - The core neutron source should account for local fuel isotopics and, where appropriate, the effects of moderator density. The neutron source normalization and energy dependence must account for the fuel exposure dependence of the fission spectra, the number of neutrons produced per fission, and the energy released per fission.

Response: Reference 1 responded to a corresponding item on pages A6 and A8.

End-of-Life Predictions - Predictions of the vessel end-of-life fluence should be made with a best-estimate or conservative generic power distribution. If a best estimate is used, the power distribution must be updated if changes in core loadings, surveillance measurements, or other information indicate a significant change in projected fluence values.

Response: Reference 1 responded to a corresponding item on page A7. In addition, no changes in core loadings, surveillance measurements, or other information have occurred that would indicate a significant change in the projected fluence values.

Spatial Representation - Discrete ordinates neutron transport calculations should incorporate a detailed radial- and azimuthal-spatial mesh of ~2 intervals per inch radially. The discrete ordinates calculations must employ (at a minimum) an S8 quadrature and (at least) 40 intervals per octant.

Response: Reference 1 responded to a corresponding item on pages A10 and A11.

Multiple Transport Calculations - If the calculation is performed using two or more "bootstrap" calculations, the adequacy of the overlap regions must be demonstrated.

Response: Reference 1 responded to a corresponding item on page A12.

Point Estimates - If the dimensions of the tally region or the definition of the average-flux region introduce a bias in the tally edit, the Monte Carlo prediction should be adjusted to eliminate the calculational bias. The average-flux region surrounding the point location should not include material boundaries or be located near reflecting, periodic, or white boundaries.

Response: Reference 1 responded to a corresponding item on page A12. Further discussion is contained in Section 2.7 (page 19) of Reference 2.

Statistical Tests - The Monte Carlo estimated mean and relative error should be tested and satisfy all statistical criteria.

Response: The required statistical testing is described in Section 2.7 on pages 19 and 20 of Reference 1.

Variance Reduction - All variance reduction methods should be qualified by comparison with calculations performed without variance reduction.

Response: The variance reduction method employed in the MCNP calculation was benchmarked against DORT calculations that do not use variance reduction. The DORT results confirmed that the variance reduction methods in MCNP were acceptable.

Capsule Modeling - The capsule fluence is extremely sensitive to the geometrical representation of the capsule geometry and internal water region, and the adequacy of the capsule representation and mesh must be demonstrated.

Response: Reference 1 responded to a corresponding item on page A13.

Spectral Effects on RTNDT - In order to account for the neutron spectrum dependence of RTNDT, when it is extrapolated from the inside surface of the pressure vessel to the T/4 and 3T/4 vessel locations using the E > 1-MeV fluence, a spectral lead factor must be applied to the fluence for the calculation of RTNDT.

Response: Reference 1 responded to a corresponding item on page A14.

Cavity Calculations - In discrete ordinates transport calculations, the adequacy of the S8 angular quadrature used in cavity transport calculations must be demonstrated.

Response: Reference 1 responded to a corresponding item on page A11.

Methods Qualification - The calculational methodology must be qualified by both (1) comparisons to measurement and calculational benchmarks and (2) an analytic uncertainty analysis. The methods used to calculate the benchmarks must be consistent (to the extent possible) with the methods used to calculate the vessel fluence. The overall calculational bias and uncertainty must be determined by an appropriate combination of the analytic uncertainty analysis and the uncertainty analysis based on the comparisons to the benchmarks.

Response:

The calculational benchmarks required in the Methods Qualification include a recommended benchmark problem set contained in NUREG/CR-6115 (Reference 3). Reference 3 presented benchmark problems based upon a typical PWR core size and fuel loads. Dominion did not perform the benchmark problems in Reference 3 as Reference 1 was already benchmarked using Pool Critical Assembly (PCA) experiments, in-vessel and ex-vessel measurements of the North Anna and Surry vessels specifically (i.e., the Reference 1 methodology is only permitted to be used on the North Anna and Surry vessels).

In addition, Reference 3 provided a comparison problem between the MCNP and DORT codes. Dominion had previously benchmarked the methodology of Reference 1 using a comparison between MCNP and DORT in the initial licensing of the Topical. Since Dominion had previously performed plant-specific benchmarks and the MCNP/DORT comparison, performance of the additional benchmark problems in Reference 3 was deemed a duplication of effort and was concluded to be unnecessary.

Fluence Calculational Uncertainty - The vessel fluence (1 sigma) calculational uncertainty must be demonstrated to be ≤ 20% for RTPTS and RTNDT determination. In these applications, if the benchmark comparisons indicate differences greater than 20%, the calculational model must be adjusted or a correction must be applied to reduce the difference between the fluence prediction and the upper 1-sigma limit to within 20%. For other applications, the accuracy should be determined using the approach described in Regulatory Position 1.4, and an uncertainty allowance should be included in the fluence estimate as appropriate in the specific application.

Response: Reference 1 responded to a corresponding item on pages A23 and A26.

FLUENCE MEASUREMENT METHODS

Spectrum Coverage - The set of dosimeters should provide adequate spectrum coverage.

Response: Reference 1 responded to a corresponding item on page A27. Note that the purpose of Reference 1 was solely to provide a method for an absolute calculation of vessel fluence. Therefore this specific requirement is not applicable to Reference 1.

Dosimeter Nuclear and Material Properties - Use of dosimeter materials should address melting, oxidation, material purity, total and isotopic mass assay, perturbations by encapsulations and thermal shields, and accurate dosimeter positioning. Dosimeter half-life and photon yield and interference should also be evaluated.

Response: Reference 1 responded to a corresponding item on page A27. Note that the purpose of Reference 1 was solely to provide a method for an absolute calculation of vessel fluence. Therefore this specific requirement is not applicable to Reference 1.

Corrections - Dosimeter-response measurements should account for fluence rate variations, isotopic burnup effects, detector perturbations, self shielding, reaction interferences, and photofission.

Response: Reference 1 responded to a corresponding item on page A27. Note that the purpose of Reference 1 was solely to provide a method for an absolute calculation of vessel fluence. Therefore this specific requirement is not applicable to Reference 1.

Response Uncertainty - An uncertainty analysis must be performed for the response of each dosimeter.

Response: Reference 1 responded to a corresponding item on page A27. Note that the purpose of Reference 1 was solely to provide a method for an absolute calculation of vessel fluence. Therefore this specific requirement is not applicable to Reference 1.

Validation - Detector-response calibrations must be carried out periodically in a standard neutron field.

Response: Reference 1 responded to a corresponding item on page A27. Note that the purpose of Reference 1 was solely to provide a method for an absolute calculation of vessel fluence. Therefore this specific requirement is not applicable to Reference 2.

Fast-Neutron Fluence - The E > 1 MeV fast-neutron fluence for each measurement location must be determined using calculated spectrum-averaged cross-sections and individual detector measurements. As an alternative, the detector responses may be used to determine reaction probabilities or average reaction rates.

Response: Reference 1 responded to a corresponding item on page A28.

Measurement-to-Calculation Ratios - The M/C ratios, the standard deviation and bias between calculation and measurement, must be determined.

Response: Reference 1 responded to a corresponding item on pages A28 and 29.

References:

1. VEP-NAF-3-A, "Reactor Vessel Fluence Analysis Methodology," April 1999.
2. Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," March 2001.
3. NUREG/CR-6115, "PWR and BWR Pressure Vessel Fluence Calculation Benchmark Problems and Solutions," September 2001.
4. Draft Regulatory Guide DG-1053, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," June 1996.